# Saliency aggregation: Does unity make strength?

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# Saliency aggregation: Does unity make strength?

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## Motivation: we investigate whether we could improve on the saliency quality by aggregating a set of predicted saliency maps.

Does the linear combination improve the prediction?

$$p(x|M_1,\cdots,M_K)=\sum_{k=1}^{K} w_k \times p(x|M_k)$$

$p(x|M_k)$ is the probability of an image pixel x from the saliency map $M_k$ to be salient, $\sum_{k=1}^{K} w_k = 1$

## Unsupervised methods to compute the weights

- **Uniform:** weights w are uniform and spatially invariant, $w_k = {}^1/_K$
- **Median**
- **M-estimators:**

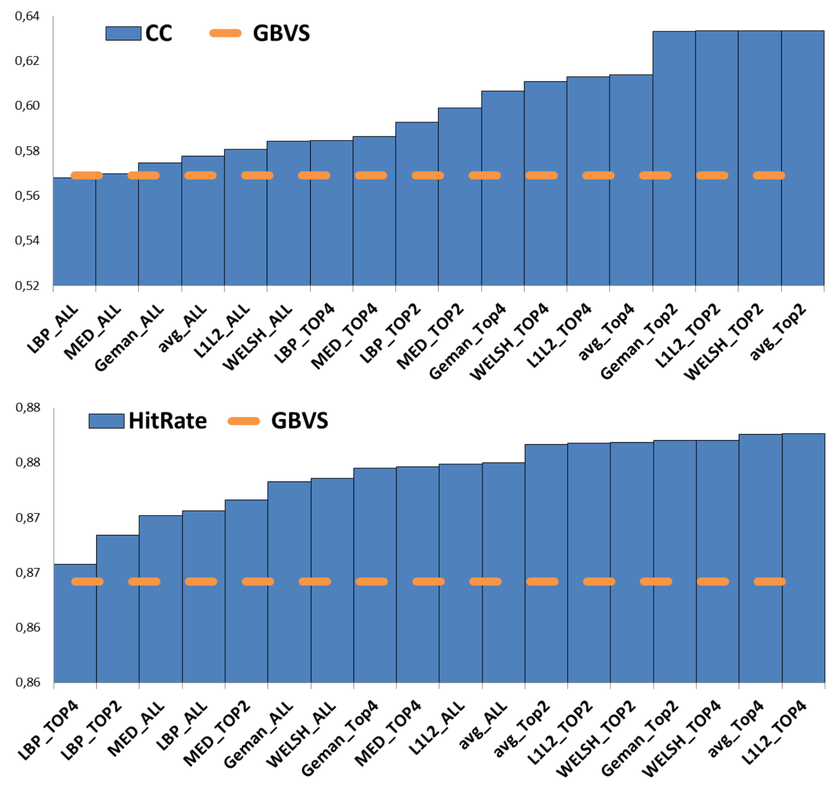
$$g_{Welsh}(e(x|M_k)) = exp\left(-{}^{e(x|M_k)^2}/_{\sigma^2}\right)$$

$$g_{L1L2}(e(x|M_k)) = {}^1/_{\sqrt{1+e(x|M_k)^2}}$$

$$g_{Geman}(e(x|M_k)) = {}^1/_{1+e(x|M_k)^2}$$

- **Global minimization of an energy function (Loopy Belief Propagation**

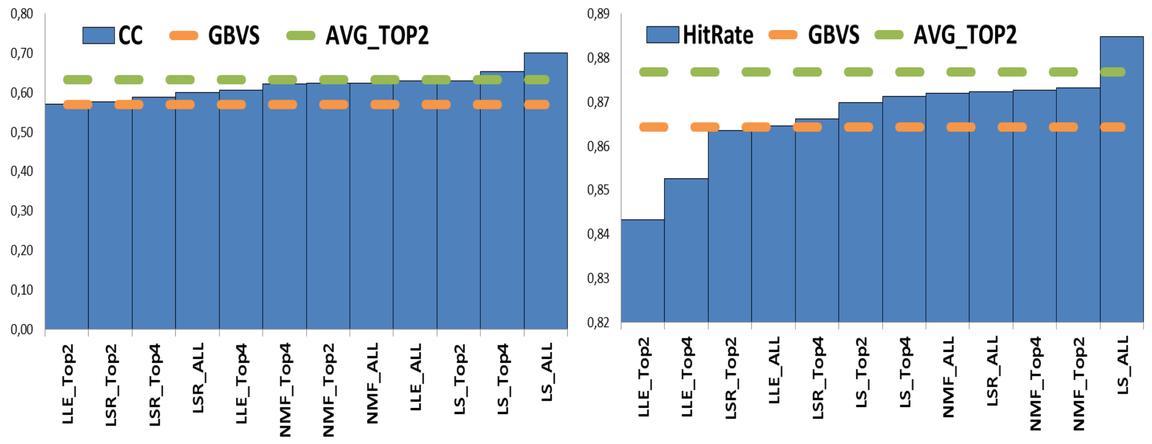
**TOP 2 : GBVS and RARE2012**
**TOP 4 : GBVS, RARE2012, Judd and AWS**
**ALL: GBVS, RARE2012, Judd, AWS, Le Meur, Hou, Itti, Bruce.**




A simple aggregation function, such as the average function, operating on the top 4 or top 2 models is a good candidate to improve significantly the performance of saliency models.

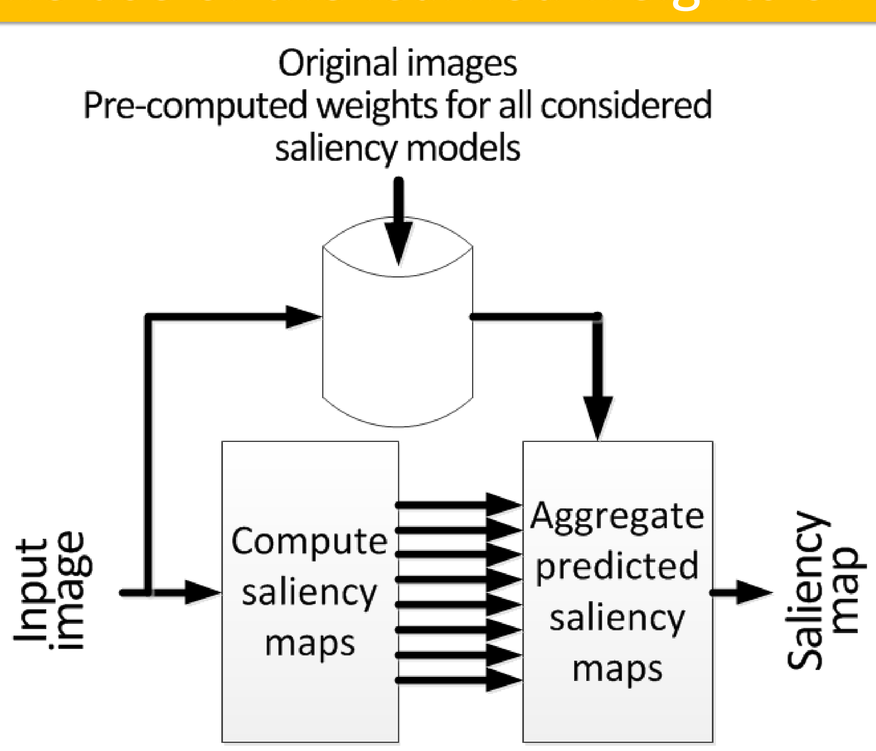
## Least-squares estimation of the weights

- **The classical least-squares method (LS)**
- **LS with the sum-to-one constraint of the weights (LLE)**
- **LS with positive weights (NMF)**
- **Robust least-squares (LSR)**

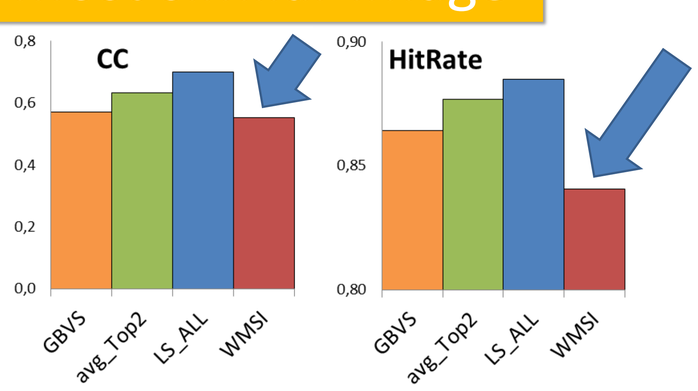



The best learning function is the simple least-squares method involving all saliency maps.

## The use of the learned weights of the most similar image

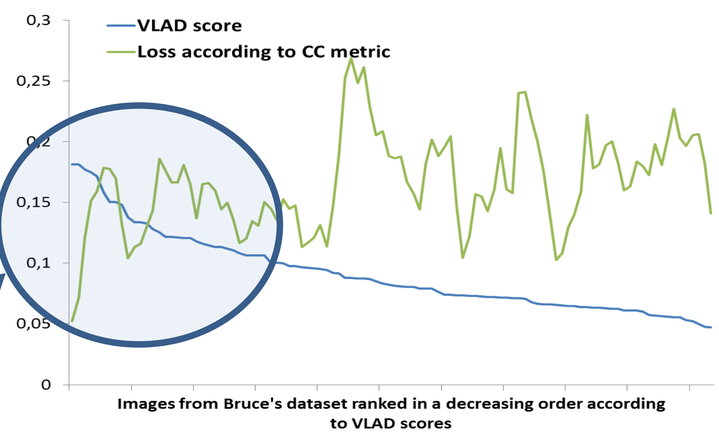



The supervised method might improve the quality of saliency map, provided that we succeed in finding an image similar to the input one.




WMSI = Weights of the Most similar Image

The WMSI method gets the lowest performance




## Conclusion

The robustness of the prediction can be enhanced by:

- ✓ averaging the saliency maps of the top 2 models;
- ✓ considering a dedicated training dataset.

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